

Chemical, Biological, Radiological and Nuclear (CBRN)
Unmanned Ground Reconnaissance (CUGR)
Advanced Concept Technology Demonstration (ACTD) Proposal
Fiscal Year 2005 ACTD Proposal

1. Statement of the military problem to be addressed: Success of current and future Military Operations is conditioned upon seeing first, understanding first, and acting decisively to secure objectives. As U.S. forces marched from Kuwait to Baghdad during Operation Iraqi Freedom (OIF), they were concerned about encountering a variety of enemy threats, including the Iraqi's use of Nuclear, Biological and Chemical (NBC) warfare agents. Intelligence reports on the Iraqi NBC threat kept U.S. forces on high alert. Operating limitations imposed by the current, 15-year-old surface contact contamination-detection technology, restricts NBC reconnaissance speeds. Further, only dismounted reconnaissance teams could access areas that are not suitable for the NBC reconnaissance vehicles. Commanders accepted risk with the current NBC reconnaissance platforms and their older surface agent detection technology.

The current chemical agent surface liquid detection capability is comprised of a vehicle mounted Double Wheel Sampling System (DWSS) and a Chemical-Biological Mass Spectrometer (CBMS). Operation of these surface contamination detection systems is time consuming, maintenance intensive, speed limited, sensitive to surface conditions, and does not provide agile or flexible employment options. The Joint Requirements Office for Chemical, Biological, Radiological and Nuclear Defense (JRO-CBRND) had recognized these limitations and identified the need for surface liquid and solid (traditional and non-traditional) agent detection as one of its top 10 requirements.

The Line-of-Site, and Field-of View considerations also limit the NBC Reconnaissance capability. The existing platforms do not offer NBC Reconnaissance capabilities into structures or other access-limited areas. Reconnaissance into these areas requires dismounted forces. While the U.S. has introduced Unmanned Ground Vehicles (UGVs) with mission specific payload packages to conduct a variety of MOUT reconnaissance operations, no NBC specific packages have been incorporated to perform surface or point NBC/TIM reconnaissance.

The CBRN Unmanned Ground Reconnaissance (CUGR) ACTD will exploit Next Generation Sensor (NGS) technology to demonstrate capability augmentation in existing mounted reconnaissance capabilities and demonstrate the military utility of unmanned ground reconnaissance systems. This capability will improve the speed of traditional zone, area, and route reconnaissance, as well as providing unmanned and restricted terrain recon. The ACTD will develop supporting CONOPS and TTPs for successful employment of the technology applications (Mounted and Unmanned Ground Reconnaissance).

2. Discussion of technologies which may potentially address the problem: The CUGR ACTD will have two technology thrust areas: Contaminated Surface Detection (CSD) which satisfies the need to improve the speed and capability of manned NBC reconnaissance (mounted); and the CBRN Unmanned Ground Vehicle (CUGV) which expands the capability to conduct NBC reconnaissance in restricted terrain.

a. Thrust Area 1 - CSD: The CSD uses Mini-Raman LIDAR technology to detect and identify surface-deposited contaminants. Target surfaces are illuminated by laser light and contaminants in the field of view are identified through analysis of their backscatter or Raman signal against a wide library of Raman spectra. The ACTD will integrate a sensor into a pre-existing military platform (HMMWV-variant of the Joint Service Lightweight NBC Reconnaissance System) to provide the following capabilities:

- 1) Liquid and solid detection of traditional chemical warfare agents (CWA), Toxic Industrial Materials (TIMs) and Non-Traditional Agents (NTAs).
- 2) Non-contact surface contamination sensing capability not requiring vehicle forward motion.
- 3) High speed operation (i.e. does not restrict the OPTEMPO)
- 4) Sensitive to low agent concentrations on a wide variety of terrain types, with no sensor saturation issues

b. Thrust Area 2 – CUGV. This Thrust Area will concentrate on combining currently available CBRN sensors onto one or more existing robotic platforms to address various areas of risk, identified by combatant commanders. Specifically, the CUGV program will integrate NBC/TIM sensors into various sensor payload modules to expand the current capability:

- 1) Remote teleoperated or autonomous, unmanned CBRN/TIM surface and point detection in areas where tactical vehicles cannot access (e.g., Urban terrain)
- 2) Remote and unmanned Biological point detection at critical nodes.
- 3) Analysis of the agent detected and electronic transmission of the report from the UGV to the manned systems or other command post without need for retrieving the sample.

c. NBC sensors of interest include a mix of fielded and developmental military and commercially available systems to include: CSD, Automatic Chemical Agent Detector Alarm (ACADA), Biological Aerosol Warning Sensor (BAWS), Dry Filter Unit (DFU), Joint Chemical Agent Detector (JCAD), Multi-Rae, AN/UDR-14, etc. These sensors will be integrated into a modular mission based suite or capability packages that will be tailorable to the intelligence estimate or mission profile.

d. Technology Readiness Level (TRL) of potential technologies and basis of estimate.

<u>Technologies/system derivatives</u>	<u>TRL/Basis</u>
Thrust Area 1	
1) Chemical Detection / Identification	
a.) CSD	TRL 5 /JPM NBC CA*
Thrust Area 2	
1) Chemical Detection/Identification	
a.) CSD	TRL 5 /JPM NBC CA
b.) ACADA	TRL 9 / JPM NBC CA*
c.) JCAD	TRL 7 / JPM NBC CA*
d.) Multi-Rae	TRL 7
2) Biological Detection/Identification	
a.) DFU	TRL 8 / JPM NBC CA*
b.) BAWS	TRL 8 / JPM NBC CA*
3) Radiological detection	
a.) AN/UDR-14 Pocket RADIAC	TRL 9 / JPM NBC CA*
b.) AN/UDR-13 Pocket RADIAC	TRL 9
c.) ADM-300A Multifunction Survey Meter	TRL 9
d.) ADM 606M Multi-purpose Radiation meter	TRL 9
4) Platform / Integration	
a.) JSLNBCRS	TRL 7 / JPM NBC CA*
b.) UGV (e.g. Scorpion, Matilda,	TBDTRL 5/6
5) Network strategy	
a.) JWARN	TRL 5/6 / JPM IS**

* Joint Project Manager for NBC Contamination Avoidance

** Joint Project Manager for Information Systems

The CUGR ACTD will be demonstrated on the HMMWV-variant of the JLNBCRS platform and assessed within an expanded mission profile. The system will be employed by a JLNBCRS unit and evaluated through an independent military utility assessment sponsored by the respective Lead Service sponsor. The CUGR ACTD technology may have application and integration opportunities on both the FOX NBC Reconnaissance System, and NBC Stryker Reconnaissance Vehicle. Participation of these platforms in the ACTD will be dependent on platform availability for the demonstration. The CUGR ACTD will also enhance capabilities of and facilitate the utility of the Future Combat System (FCS) UGV program through the demonstration of NBC operational missions not currently available. The resultant CSD and CUGV

systems will address the acquisition goals of the Joint Program Executive Office Chemical Biological Defense (JPEO CBD) and the Program Executive Office Ground Combat Systems (PEO GCS).

3. Discussion of how the proposed ACTD will support Joint or Combined

operations. The CUGR affords Joint and Combined force commanders a versatile suite of systems that provides critical input to the Intelligence Preparation of the Battlefield (IPB) process. Force commanders will employ the CUGR ACTD platform to detect a wide variety of traditional chemical agents along with TIMs and Non-Traditional Agents (NTAs). CUGR will afford Commanders with a reconnaissance capability that increases realistic NBC reconnaissance tempo over current systems, assures more timely warnings of CBRN contamination, provides a TIM/NTA capability, and will demonstrate an unmanned capability to remote/limited access areas. Operators will use the unmanned ground vehicle independent of, or in tandem with, manned platforms and will control it directly or preprogram its mission routes. The unmanned ground vehicle capability will also conduct reconnaissance utilizing non-line-of-sight command and control, and will perform surveillance at critical nodes.

4. Description of demonstration/demonstrations envisioned or to be conducted, including objective outcomes and goal of envisioned demonstrations. The CUGR will be tested in a combination of laboratory and operational environments, as follows:

- a. Field-testing will be conducted to determine the effectiveness of the system. The CSD will be tested at Dugway Proving Ground (DPG), UT against operationally relevant surface agents while integrated on its intended platform. Testing will validate the probability of detection (PD), probability of identification (PID), and sensitivity levels. The unmanned ground vehicle will be tested in an established restricted terrain environment at DPG to determine the performance parameters of each sensor package.
- b. Field-testing will be conducted to determine: 1) the adequacy of system CONOPS, and 2) system suitability. The system will run on its intended platform with operators to determine the reliability, availability, and maintainability. The system support package, Contractor Logistics Support (CLS), and 2-level maintenance will be evaluated throughout the test. The interoperability of the system with its platform and command and control system will also be evaluated. A suitable urban terrain or restricted terrain environment location will be used for this aspect of the demonstration.
- c. Testing will be conducted to demonstrate system survivability.
- d. The CUGR demonstration will provide adequate test data to the independent evaluators to support Milestone C (entry into Low Rate Initial Production) of the CUGR manned NBC reconnaissance vehicle enhancement concept and Milestone B (i.e., a proof of principle) of the unmanned ground reconnaissance vehicle.

5. Estimated Schedule for the ACTD.

a. FY05 Activities.

- 1) Complete CSD and CUGV warfighter experiment, military utility assessment, and continue CONOPS development.
- 2) Develop warfighter requirements and needs to for both CSD and CUGV concepts.
- 3) Complete CSD engineering design tests and system design.
- 4) Complete platform modeling and human factor test and integrate CSD with CBRN sensors onto NBC Reconnaissance platform.
- 5) Perform CSD field trials with simulants on various terrains.
- 6) Identify and obtain CBRN detection suite components for CUGV.
- 7) Develop communication specifications CUGV. Optimize the “on-board” versus “on the ground” signal and digital data processing requirements.
- 8) Evaluate UGV platforms
- 9) Obtain UGV platform
- 10) Develop CSD and CUGV Acquisition, Transition and Test Planning.
- 11) Initiate test technology and methodology development.

b. FY06 Activities.

- 1) Conduct CSD early user assessment and incorporate key user required design changes to the CSD system prior to the start of the Operational Test (OT).
- 2) Complete test technology and methodology development on the CSD.
- 3) Complete technical manual and user training prior to the start of the CSD OT.
- 4) Conduct CSD OT on NBC Reconnaissance platform.
- 5) Initiate CUGV system design and integration of modular capability packages.
- 6) Complete CUGV engineering design tests and system design.
- 7) Continue CSD and CUGV Acquisition, Transition and Test Planning.
- 8) Complete CSD CONOPS development and continue CUGV CONOPS development.

c. FY07 Activities.

- 1) Conduct CSD Milestone C.
- 2) Field CSD equipped NBC Reconnaissance platforms to designated HMMWV JSLNBCRS unit.
- 3) Provide and Support CSD residuals.
- 4) Complete CUGV system design, integration and optimization of signal processing and data transmission electronics.
- 5) Conduct CUGV early user assessment and incorporate key user required design changes to the CUGV system prior to the start of the OT.
- 6) Complete test technology and methodology development on the CUGV
- 7) Complete technical manual and user training prior to the start of the CUGV OT.
- 8) Conduct CUGV OT.
- 9) Continue CUGV Acquisition, Transition and Test Planning.

d. **FY08 Activities.**

- 1) Continue CSD residual support.
- 2) Conduct CUGV Milestone B.
- 3) Field CUGV to designated HMMWV JSLNBCRS unit.
- 4) Provide CUGV residual support.

6. **Table listing estimated project cost** (with basis of assessments), recommended funding participants and finding profile. As soon as possible, provide authorization points of contact in funding organizations.

Funding (\$ Thousands)					
Source	FY05	FY06	FY07	F08	Total
DTRA	13150	16125	7750	1025	39150
DUSD	3600	2900	1400	1400	8200
Total	16750	19025	9150	2425	47350

7. **Risk assessment for estimated technical and finding requirements.** A brassboard CSD sensor was mounted to a vehicle platform and successfully detected simulants in field trails on secondary roads at 30 kph. The same sensor successfully detected low concentrations of some traditional CWAs, NTAs, and TIMs in the laboratory with very promising results. A UGV CBRN sensor suite comprised of a UDR-14, Multi-Rae, and JCAD has been technically demonstrated by SPAWAR (US Navy). Several UGVs have been developed and used by soldiers with some success.

- a. Surface Chemical Detection and Identification. Moderate for the Laser Interrogation Surface Detector (CSD)
- b. Point Chemical Detection and Identification. Low for established technology.
- c. Biological Detection/Identification. Low to Moderate
- d. Radiological Detection. Low
- e. Platform / Integration. Moderate
- f. Network Strategy. Moderate

8. **Statement of proposed Lead Service/Agency and User Sponsor:** The Army and Marine Corps would be equipped with CSD and UGVs. The Army will be the sponsoring command and lead service. Other participants include: Joint Forces Command (JFCOM), Pacific Command (PACOM), Central Command (CENTCOM), Research Development and Engineering Command (RDECOM), Edgewood Chemical Biological Center (ECBC), JPEO CBD, JPM NBC CA, PM UGV, PM UAV, U. S. Army Chemical School (USACMLS), Maneuver Support Center Directorate of Combat Development (MANSCEN –DCD), Army Test and Evaluation Command (ATEC).

- a. Lead Service points of contact. COL Tom Spoehr (HQDA), Lead Service Transition Manager POC: Dr Dave Cullin (JPEO CBD).
- b. Has this proposal been coordinated with the Lead Service points of contact? In process
- c. Has this proposal been coordinated with the User Sponsor points of contact? US Pacific Command (USPACOM), Mr. Chris Vogt, Command Science Advisor
- d. Has this proposal been coordinated with the appropriate User Sponsor Component? US Army Pacific, LTC John Esce, Command Chemical Officer

9. Identification of potential residual assets/capabilities to include potential ownership/supportability issues. Residual assets will consist of 3 CSD equipped HMMWV JSLNBCRS vehicles, and 4 CUGVs with their CBRN mission modules. All residuals will include CLS for a period of two years.

10. Projection of transition strategy.

- a. List relevant Lead Service/Agency transition organizations. JPEO CBD
- b. Identify potential transition strategy and funding issues. Transition will be coordinated and managed by the ACTD Transition Manager, JPEO CBD. The technical and operational test results of this demonstration will validate the ability of developmental hardware to meet performance requirements. The CSD will transition directly into the JSLNBCRS production and fielding efforts. If the ACTD is successful in demonstrating the technology, it may be applied in other areas, such as a post-production product improvement of the Stryker Reconnaissance Vehicle and M93 NBC Reconnaissance System. The CUGV will transition into the System Design and Demonstration phase of a new UGV program under the JPM NBC CA in coordination with PM UGV. The CONOPS development executed during FY04 and FY05 will enable the documentation of an Initial Capabilities Document (ICD) with identified draft key performance parameters identified as targets to be pursued for this system. Upon successful completion of the ACTD demonstration, the document can be finalized with service concurrence coordinated by the Joint Requirements Office for CBRN Defense. This document will enable the JPEO-CBD to develop its acquisition strategy for a System Development and Demonstration phase acquisition program for this component of the system. This program office would then continue to provide life cycle support for the residuals and if necessary further produce more end items/test articles as an interim capability prior to achieving Approval for Full Production.

11. CUGR ACTD point of contact. Mr. Greg Walker, DTRA, Joint Science and Technology Office for Chem/Bio Defense, Transition Division (703) 325-8169, DSN: 221-8169, Fax: (703) 325-2136, Gregory.Walker@DTRA.MIL.